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Associations Between Demographic Factors and Suicide Deaths in Vermont: 2015-2019

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INTRODUCTION

Suicide mortality is a major public health concern in the United States.¹ In 2018, suicide was the tenth leading cause of death in the United States² and the eighth leading cause of death in Vermont.³ The etiology of suicide is complex and linked to many risk factors, both biological and environmental.⁴

The rate of suicide is greater in rural areas, as compared to urban areas.⁴ Across all levels of urbanization, the rate of suicide is greatest among non-Hispanic whites, American Indians, and Alaska Natives.⁴ Suicide is more common among male individuals and the highest rates of suicide occur among individuals 35 years of age and older.⁴ Increased risk of suicide is observed among individuals who do not complete high school⁵ and among those who are single, divorced, or widowed.⁶

Despite the characterization of these demographic risk factors, adequate suicide prevention strategies remain a public health priority. Our objective was to quantify the dynamic relationships shared between the numerous risk factors associated with suicide using data from the Vermont Electronic Death Registration System (EDRS).⁷

METHODS

This cross-sectional study was conducted using 2015-2019 Vermont EDRS data.⁷ Individuals included in the EDRS database were Vermont residents who died within the state. Suicide, as identified using International Classification of Diseases 10th revision (ICD-10) criteria,⁸ was investigated as the primary outcome of interest. Demographic variables were analyzed for associations with suicide.

Several variables were recoded to simplify analyses. Race was collapsed into a dichotomous variable due to small representation of Black, Indigenous, and people of color (BIPOC) in the sample, with white decedents as the reference group. Marital status was consolidated as married (reference), never married or in a civil union, widowed, divorced, or other. Educational attainment was recoded as high school graduate or equivalent (reference), 8th grade or less, 9th-12th grade, some college credit, associate degree, bachelor's degree, master's degree, or doctorate or professional degree. Sex was recoded to females or males

(reference). United States Department of Agriculture data was utilized to convert city town codes into Rural Urban Commuting Area (RUCA) scores based on ZIP code.⁹ A higher RUCA score indicated increased rurality.

Binary logistic regression analyses were performed to examine each demographic variable's association with suicide. Variables included in the regression model demonstrated marginal statistical significance during bivariate analysis ($P < 0.25$). Non-significant variables were removed in stepwise fashion, leaving only significant risk factors of interest ($P < 0.05$). The variables included in the final model were age, sex, race, RUCA score, marital status, and educational attainment. Stratified analyses were also performed to examine sex-specific associations between demographic variables and suicide.

The University of Vermont Institutional Review Board has reviewed this project and determined that it qualifies as exempt from additional review. Statistical analyses were performed using IBM SPSS Statistics (Version 27).

RESULTS

26,738 deaths were reported in Vermont during the identified timeframe, with 535 deaths attributable to suicide. Most individuals who died by suicide were white (97.0%), male (79.3%), between 51 and 70 years old (36.6%), never married or in a civil union (40.2%) or held an 8th grade or less education level (43.0%) (Supplementary Table 1).

Age was analyzed as a continuous variable, whereas sex, RUCA score, marital status, and educational attainment were analyzed as categorical variables, with defined reference groups (Table 1). Increased age was negatively associated with the odds of suicide (odds ratio [OR] = 0.931; 95% confidence interval [CI] = 0.925, 0.936; $P < 0.001$), and females exhibited 60.5% lower odds of suicide than males (OR = 0.395; 95% CI = 0.317, 0.494; $P < 0.001$). The odds of suicide were 1.785 times greater among divorced individuals compared to married individuals (95% CI = 1.396, 2.281; $P < 0.001$), while the associations between suicide and other marital statuses were nonsignificant. Five education categories significantly predicted the odds of suicide. Individuals with 8th grade or less education showed 89.7% lower odds of suicide (OR = 0.103; 95% CI = 0.058, 0.183; $P < 0.001$),-whereas having an associate degree (OR = 1.472; 95%

CI = 1.033, 2.098; $P = 0.032$), a bachelor’s degree (OR = 1.686; 95% CI = 1.266, 2.247; $P < 0.001$), a master’s degree (OR = 1.812; 95% CI = 1.162, 2.826; $P = 0.009$), or a doctorate or professional degree (OR = 3.345; 95% CI = 1.979, 5.651; $P < 0.001$) were associated with increased odds of suicide. Higher RUCA score was positively associated with the odds of suicide (OR = 1.043; 95% CI = 1.016, 1.071; $P = 0.002$). The association between race and suicide was nonsignificant ($P = 0.730$).

Stratification by sex showed that sex-specific models generally agreed with the unstratified model (Supplementary Table 2). However, BIPOC status (OR = 2.985; 95% CI = 1.239, 7.193; $P = 0.015$), having some college credit but no degree (OR = 2.273; 95% CI = 1.248, 4.137; $P = 0.007$), and having a bachelor’s degree (OR = 3.539; 95% CI = 2.056, 6.089; $P < 0.001$) were positively associated with the odds of suicide among females, while these variables were nonsignificant among males. In contrast, RUCA score (OR = 1.042; 95% CI = 1.011, 1.073; $P = 0.007$) and having a master’s degree (OR = 1.811; 95% CI = 1.099, 2.987; $P = 0.020$) were positively associated with odds of suicide among men but were nonsignificant among women.

TABLE 1: STRENGTH OF SELECTED DEMOGRAPHIC CHARACTERISTICS’ ASSOCIATION WITH SUICIDE: VERMONT EDRS (2015-2019)

DEMOGRAPHIC VARIABLE	Odds Ratio (95% CI)	P value
AGE	0.931 (0.925, 0.936)	<0.001
SEX	0.395 (0.317, 0.494)	<0.001
RACE	1.106 (0.624, 1.960)	0.730
RUCA SCORE	1.043 (1.016, 1.071)	0.002
MARITAL STATUS		
MARRIED	Reference	<0.001
NEVER MARRIED OR IN CIVIL UNION	0.999 (0.755, 1.323)	0.997
WIDOWED	0.910 (0.596, 1.389)	0.662
DIVORCED	1.785 (1.396, 2.281)	<0.001
OTHER	1.172 (0.453, 3.035)	0.743
EDUCATION LEVEL		
HIGH SCHOOL GRADUATE OR GED COMPLETED	Reference	<0.001
8TH GRADE OR LESS	0.103 (0.058, 0.183)	<0.001
9TH-12TH GRADE	0.950 (0.707, 1.277)	0.734
SOME COLLEGE CREDIT BUT NO DEGREE	1.209 (0.894, 1.635)	0.219
ASSOCIATE DEGREE	1.472 (1.033, 2.098)	0.032
BACHELOR'S DEGREE	1.686 (1.266, 2.247)	<0.001

MASTER'S DEGREE	1.812 (1.162, 2.826)	0.009
DOCTORATE OR PROFESSIONAL DEGREE	3.345 (1.979, 5.651)	<0.001
UNKNOWN	0.131 (0.029, 0.599)	0.009

DISCUSSION

Analysis of 2015-2019 Vermont EDRS data indicated younger age, male sex, divorce, rurality, and certain education levels were significantly associated with death by suicide, agreeing with trends in the literature. Prevalence of suicide deaths in the demographic categories largely aligned with other studies indicating greater suicide rates in rural areas and among non-Hispanic whites, older individuals, males,⁴ individuals who did not complete high school,⁵ and individuals who were never married.⁶ Interestingly, sex-stratified models showed odds of suicide for women in rural areas were not elevated.

Multiple levels of higher education held strong positive associations with suicide across both the overall and sex-stratified regression models. This finding contradicted previous studies indicating educational attainment was either not associated with suicide risk or completing college was protective for non-Hispanic Whites compared to non-Hispanic Blacks.¹⁰ Lower educational attainment has been characterized as a suicide risk factor,¹¹ in contrast to the protective effect observed in decedents with education of 8th grade or less in this study. Race was also remarkable for insignificance in all models except the female regression, considering previous studies showed increased mortality, including suicide, among white non-Hispanic Americans.¹² Our unique findings may be artifacts of small sample size.

Use of a cross-sectional study allows timely analysis of a large dataset but limits the ability to determine causal relationships among variables of interest. Differences in male versus female sample sizes may affect statistical power in the stratified models. Furthermore, the overall population may hold underlying cohort differences, historical experiences, or other experiences limited to Vermont. Accordingly, findings may be representative for populations of similar composition, but likely lack generalizability due to the lack of racial diversity in Vermont.

Based on the implications of our results, we recommend future investigations into the correlates of suicide, whether higher education is associated with suicide in other populations, and sex-specific differences in risk due to RUCA score and race. Our identified risk factors must

be taken into special consideration during mental health screening practices to better prevent suicide among Vermonters.

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